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SHOULD VITAMIN D BE GIVEN ONLY TO INFANTS?

VITAMIN D has been so successful in preventing rickets during infancy that there has been little emphasis on continuing its use after the second year.

But now a careful histologic study has been made which reveals a startlingly high incidence of rickets in children 2 to 14 years old. Follis, Jackson, Eliot, and Park* report that postmortem examination of 230 children of this age group showed the total prevalence of rickets to be 46.5%.

Rachitic changes were present as late as the fourteenth year, and the incidence was higher among children dying from acute disease than in those dying of chronic disease.

The authors conclude, "We doubt if slight degrees of rickets, such as we found in many of our children, interfere with health and development, but our studies as a whole afford reason to prolong administration of vitamin D to the age limit of our study, the fourteenth year, and especially indicate the necessity to suspect and to take the necessary measures to guard against rickets in sick children."

*R. H. Follis, D. Jackson, M. M. Eliot, and E. A. Park: Prevalence of rickets in children between two and fourteen years of age, Am. J. Dis. Child. 66:1-11, July 1943.

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SUBDURAL HEMATOMA

Case Report No. 22

Dr. Sidney Ross E. T.—45-3202

E. T., a five month old colored female infant was admitted to Children's Hospital on April 20, 1945 because of progressive enlargement of the head of one month's duration. During this interval, there had been attending vomiting episodes, occurring shortly after each feeding and being forceful in nature. The infant had also manifested a considerable degree of restlessness during the week prior to entry. No history of convulsions was elicited.

The infant was born at home, one of twins, and delivered as a vertex presentation. In so far as could be determined, there was no history of trauma either during delivery or during the postnatal period. Post partem, the infant was placed on a formula, and initially took her feedings rather well, but during the two months prior to admission, the formula was taken rather poorly. Vitamin supplements were given in adequate quantities. Family history was not significant in regard to the present illness.

Physical examination revealed a poorly developed, marasmic, chronically ill infant who appeared listless and weak and uttered an occasional feeble cry.

The head was grossly enlarged, measuring 43.9 cm. in circumference as compared to the chest circumference of 38 cm. The anterior fontanel was bulging and tense, measuring 7 cm. in diameter, while the posterior fontanel was 3 cm. All the suture lines were palpable, and the sagittal suture admitted one finger along its entire length. There was noticeable frontal bossing, and the biparietal diameter of the head appeared larger than the frontal-occipital axis.

Examination of the eyes revealed a wide staring gaze, bilateral exopthalmos, a downward displacement of both eyeballs with sclerae visible above the iris and a widening of the palpebral fissure. Pupils reacted sluggishly to light. Extra-ocular movements appeared in good order, the infant following a light in normal fashion. Fundoscopic examination showed no papilledema, optic atrophy, nor retinal hemorrhages. The vessels and maculae appeared normal.

Ears, nose and throat were negative. There was slight beading of the costo-chondral junction with some suggestion of a Harrison's groove. Heart and lungs were negative. The liver was just palpable about one cm. below the right costal margin. The spleen was not felt.

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There appeared to be no paralysis of the extremities, the motor function seeming to be unimpaired. The infant responded adequately to sensory

POST-MORTEM SPECIMEN OF AN INFANT, ILLUSTRATING MARKED COMPRESSION ATROPHY OF THE CORTEX RESULTING FROM BILATERAL SUBDURAL HEMATOMA
Note deep subdural space on both sides

stimuli. Reflexes were hypoactive throughout. Babinskis were positive bilaterally.

Skin turgor was poor with gross evidence of dehydration. There were several eroded, ulcerated lesions about 1–2 cm. in diameter over the perineum, labia, and buttocks.

Hemogram showed a red-cell count of 3,100,000 with 6.5 gms. of Hgb. The white-cell count was 8,300 with 68% polys. Bleeding, clotting and prothrombin times were within normal range. No sickling was noted. Urinalysis was essentially negative. No excess fat and starches were found in the stool. The blood Wassermann and Kahn tests were negative.

Roentgenological examination of the long bones revealed some thickening of the periosteum of both femora, but was otherwise not remarkable. X-ray of the skull in the anterior-posterior and lateral positions showed a wide open posterior and anterior fontanel and a gross deficiency in calcification of the cranial bones.

Because of the pronounced enlargement of the head circumference with a biparietal predominance, bilateral subdural taps were performed and yielded a light mahogany-colored fluid under considerably increased pressure on both sides. The fluid obtained on the left side was slightly darker than on the right, the former having an icterus index of 42 units, the latter 25 units. Protein content of the fluid on the left was 2.19 gms. %, that of the right 2.42 gms. %. There were many crenated red cells present, and centrifuging yielded a supernatant xanthochromic fluid. Lumbar puncture also showed the same mahogany-colored fluid as was present in the subdural space. The presence of bloody spinal fluid indicated that the subdural hematoma had extravasated into the subarachnoid space.

During the next 2 weeks, daily aspirations of the subdural spaces were performed in order to achieve a gradual decompression, about 10 cc. being removed at each sitting. The fluid became progressively lighter and the protein content decreased. No untoward sequellae resulted from these frequent subdural taps. During this time, the infant received almost daily plasma infusions, together with several blood transfusions. Concomitantly, the vomiting episodes subsided after the initiation of this regime and her nutritional status improved perceptibly. Similarly, she appeared considerably less fretful than on entry.

On May 15, 1945, under general anesthesia, a bone flap was turned down on the right front-parietal-temporal side after establishing the presence of a membranous subdural sac by a preliminary trephination. The dura was reflected by blunt dissection. The outer membrane of the sac measured 3 mm. and was vascular; the inner membrane measured 1 mm. and was avascular. The contents of the sac were aspirated and the sac was irrigated. Both membranes were then stripped from the dura and arachnoid surfaces and removed to the limits of the dural opening. After evacuation of the subdural sac, the cortex, which was depressed about 3 cm. from the inner table of the calvarium, failed to expand to any significant degree. The dura, subcutaneous tissue, and skin were closed with interrupted cotton sutures and the dura sutured to the periosteum. Post-operatively,

the infant received blood and plasma infusions together with other parenteral fluids.

One week later on May 22, 1945, a bone flap was turned down on the left side in the same manner as previously described and a membranous subdural sac was similarly removed.

The infant tolerated both these procedures well and at the present time, her condition remains satisfactory.

Discussion

The etiology of the subdural hematoma in this infant is not too certain. There was no elicitable history of trauma, either during delivery or during the postnatal period. However, this does not preclude trauma as a direct possibility, since as pointed out by Ingraham and Matson (1) in their excellent discussion of subdural hematomas in infancy, it is frequently impossible to obtain an accurate history of the circumstances of delivery. Furthermore, head injuries resulting from falls during the postnatal period may appear to be inconsequential and thus pass unnoticed or be forgotten by the parent and yet be sufficiently traumatic to give rise to a subdural hematoma. This could result from an avulsion of the tributary veins leading from the superior aspect of the cerebral cortex to the longitudinal sinus. Indeed, trauma as the chief etiological agent producing subdural hematomas in infancy appears to be the most attractive single explanation; however it still fails to reconcile the disparity between the innumerable instances of head injuries in infants resulting from falls, and the relatively infrequent number of cases of subdural hematomas. There are probably other contributory factors such as scurvy (2), vitamin K deficiency, anemia, chronic infections, etc.

The duration of the subdural hematoma in our case is indeterminate. As previously noted, the onset of head enlargement was observed about one month prior to admission when the infant was three months of age. It is not unlikely that the lesion occurred at birth and then a latent period ensued before any noticeable hydrocephalus appeared. Zollinger and Gross (3) explain this latent period on the basis of the sac acting as a semi-permeable membrane and that blood within a subdural hematoma breaks down slowly over a period of months; the disintegration of this blood produces a sizable rise in osmotic pressure within the sac, resulting in a withdrawal of fluid from neighboring tissue spaces. This would explain the slow but definite progression in head size frequently seen in subdural hematomas. It should be emphasized, however, that in 98 cases of subdural hematoma reported by Ingraham and Matson (1), only 28 infants showed hydrocephalus on entry. These investigators (1) found that the most common symptoms in their series were convulsions (58%), vomiting

(50%), hyperirritability (38%) and stupor (28%). The most frequent physical findings were a temperature variation (either elevated or subnormal) present in 83% of the cases, hyperactive reflexes (55%), bulging fontanel (32%), enlargement of the head (28%), abnormal fundi (23%), paralysis (15%), fractured skull (10%), and scorbutic changes (20%). As can be inferred, infants with a subdural hematoma may frequently fail to show the neurological signs and hydrocephalus usually described as typical of the disease. The picture may be simply that of an infant appearing acutely or chronically ill who may have an elevated or a subnormal temperature and appear somewhat malnourished. This clinical picture may be simulated by many other diseases, and in no way represents a characteristic symptom complex. According to Ingraham et al (1), a frequent triad includes:

1. Failure to do well, as evidenced by lack of normal weight gain, refusal of feedings, hyperirritability and irregular temperature swings accompanied by,
2. An accelerated increase in head size.
3. A history of difficult labor or delivery.

The 98 cases at the Boston Children's Hospital covering a period from 1937 to 1943 reported by these authors is a distinct tribute to the alertness of their hospital staff in making the diagnosis. Most hospitals do not diagnose more than 3 or 4 cases per year in infants.

The only way of definitely establishing the presence of a subdural hematoma is by a subdural tap. It is a simple diagnostic procedure and can be done by any member of the house staff after a modicum of experience. Aseptic technique should be strictly observed. All pediatricians should be acquainted with the procedure since it should be essentially a pediatric diagnosis. One point which should be emphasized is the desirability of performing a subdural tap in *all* instances of hydrocephalus to ascertain whether a subdural hematoma, rather than an idiopathic internal hydrocephalus, exists. This differentiation is of considerable importance since the prognosis is so different in these two conditions. Not infrequently, an infant with abnormal head enlargement is summarily labeled as having idiopathic internal hydrocephalus with a rather hopeless prognosis and later demonstrated to have a subdural hematoma. The time element is of considerable importance, since the shorter the interval between the onset of hemorrhage and establishment of the diagnosis, the better the prognosis for recovery.

In Ingraham's series (1), treatment consisted of gradual decompression of the subdural sac by daily aspirations over the course of one or two weeks, during which time the general health of the infant was improved by blood and plasma infusions and other supportive measures. A trephination was

then performed to determine the presence or absence of a membrane. If the latter was present, a bone flap was elevated, and the membrane was removed. Their report of 77% recoveries in 57 cases with a follow up of more than six months, justifies this combination of conservative and radical surgical intervention.

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TOXOPLASMOSIS

Case Report No. 23

Dr. Frederic Burke J. C. G.—39-8659

J. C. G., a twelve year old white male, was admitted to this hospital on February 7, 1945 from the dispensary for a clinical and laboratory work up. In reviewing the previous x-rays of this patient a point of differential diagnosis was raised and through the coöperation of the Social Service Department the patient was readmitted for complete study.

Past history revealed that the birth of the patient had been normal and that the child was one of three siblings. The first child, a girl, died at the age of thirteen months of tuberculous meningitis, the second, a thirteen year old boy, is apparently well. The only past illnesses in the latter's history were an attack of pleurisy and recurrent episodes of asthma. Following the delivery of the patient the accoucher declared to the mother that he did not expect the child to live because the baby was cyanotic, immature and would not feed well. His first year of life was characterized by repeated episodes of difficulty in feeding. Lactic acid milk employing dropper technique was necessary during this time. Muscular development was very poor and the child failed to hold up his head until the fifth month at which time it was noticed that he failed to move his left arm. The mother characterized this finding as more of a localized weakness than an actual paralysis. Dentition did not occur until after the twelfth month and he failed to take his first step until after two years. He had no respiratory difficulties during this time but was markedly underweight and malnourished. The child's subsequent development was retarded but progressed slowly. He spoke his first words at three years of age. The left ear spontaneously drained at the age of six months and this has persisted until the present time. The right ear has also intermittently drained since his infancy.

He was admitted to this hospital at the age of six years with the symptoms of meningitis, his illness at that time being characterized by fever and nuchal rigidity. He was hospitalized for ten days at that time and was discharged without any special recommendations. Following this sickness he had several episodes of respiratory symptoms but at the age of seven years seemed to improve. Severe headaches, present from the age of three years and frequently accompanied by vomiting, decreased in number and respiratory infections similarly were less frequently observed. At about this time the patient complained of intermittent joint pains particularly in the lower extremities which resulted in a stiff-legged gait.

He was mentally retarded and could not remember past events. He could not count up to ten and apparently could not retain knowledge. Much of this retardation, according to the mother, was probably due to his hearing difficulties. Poor vision became manifest during these early years and the child was not fitted with glasses until he was nine years of age. The mother believes that the denial of these two senses constitutes in great measure the cause for his restricted intelligence. His behavior was negativistic and he exhibited severe temper tantrums.

J. C. G.—Toxoplasmic Intracerebral Calcifications

The patient was transferred to a tuberculosis sanatorium in Virginia on July 8, 1944 from our dispensary. At that institution acid-fast organisms were isolated from the urine. He was transferred from that institution to this hospital at our request when a review of the x-rays of the skull taken in 1939 seemed characteristic of toxoplasmosis.

The family history was significant in that the father had active tuberculosis which was undiagnosed until after the birth of the patient. There was no other significant history.

A review of the hospital chart of patient's 1939 admission revealed the child had been discharged with the diagnosis of healed tuberculosis in-

J. C. G.—Toxoplasmic Intracerebral Calcifications

volving the lungs, brain and choroid. X-rays of the chest taken at that time revealed large calcified nodes at the roots of the lungs and some infiltration in the left lower lobe. Multiple calcifications were observed in the

skull plates and were interpreted as calcified tubercles. Additional impressions upon that admission were anterior poliomyelitis (because of left upper extremity weakness) and chronic suppurative otitis media. Repeated attempts to isolate acid-fast organisms from the stomach, spinal fluid and sputum were all negative. The tuberculin test was positive.

Physical examination upon the present admission revealed a fairly well nourished, somewhat underdeveloped white male who did not appear to be acutely ill. The child wore an audiometer without the help of which he could not hear. He had a right abducens paralysis. An examination of the fundi revealed a large macular lesion in the right retina which was reddened and surrounded in its periphery by increased pigmentation. There was an absence of the left deltoid muscle. The remainder of the examination was essentially negative. X-rays of the skull revealed no change in the previously described intra-cerebral calcifications scattered throughout the brain. Examination of the genito-urinary tract by intravenous pyelogram revealed some clubbing of the superior major calix with fixation of the right renal pelvis, interpreted as being indicative of infection possibly tuberculous in character. Attempts to isolate tubercle bacilli from the urine were repeatedly negative however. The patient was afebrile during his five week course in the hospital and was then discharged to the mother's care. X-rays of the extremities failed to reveal any abnormalities and attempts to have toxoplasmic antibody determinations made on the patient's and mother's blood were unsuccessful since no laboratory in this area is performing this test at the present time.

Discussion

The protozoa toxoplasma was first identified in 1909 (1) but it was not until 1939 that its etiologic character as a disease in humans was made clear. These organisms which vary in size from four to seven μ have been identified in many smaller animals including the rabbit, dog, monkey, birds, etc. and is pathogenic for these animals. The organism may be visualized in the fresh state or by staining smears with Giemsa or Wright stains.

Wolf, Cowen and Paige (2) and Sabin (3) were the first to note the pathogenic properties of toxoplasma in human beings. Three clinical forms of the disease are recognized in humans: (1) congenital, (2) childhood and (3) adult. In the congenital type the neurotrophic properties of the parasite are responsible for most of the manifestations which are evidenced by hydrocephalus or microcephalus, chorioretinitis, convulsions and intracerebral calcifications. Presumably the organisms invade the foetus through the placental blood. In this type the signs are frequently present

from birth; however, weeks or even months may pass before the disease is clinically evident. The second type, occurring in children, is apparently rare from the paucity of reports of this disease occurring in patients of this age group. The adult type frequently passes unrecognized and may cause no symptoms. However, fever, rashes and atypical pneumonia is a commonly observed triad of the acquired type in adults. It is probable that toxoplasmosis may give rise to a variety of other symptoms and signs involving other organs and tissues. Some cases of encephalitis in children have recently been ascribed to this cause.

The clinical picture of toxoplasmosis, especially the congenital type, when the triad of chorioretinitis, convulsions and intra-cerebral calcifications are present, constitute a strongly suggestive syndrome but the diagnosis may only be absolutely established by certain laboratory procedures. These are, the isolation of the organism in body fluids or at autopsy or by the demonstration of specific antibodies in the blood. Injection of infected body fluids into guinea pigs, isolation of the toxoplasma and subsequent examination for pathogenicity of the strain is sometimes necessary to definitely establish the diagnosis. The demonstration of neutralizing antibodies from the blood of the patient and the mother of the patient is less tedious and gives good evidence that the disease is or has been present. Few laboratories, however, at the present time are equipped to perform these tests.

Many drugs including atabrine, mapharsen and quinine have been found capable of killing toxoplasma in a test tube but fail to protect infected mice. Sulfapyridine and sulfathiazole, however, affected a cure in mice when the infection was not too severe. Seemingly these drugs are toxoplasmacidal when the organisms are not too numerous or particularly virile. Sabin (4) reports protection of mice against the infection with sulfathiazole as long as the blood concentration of the drug is maintained between 1 and 3 mgm. per cent. Although no cures of the severe type of the disease in humans have been reported, it is suggested from animal experimentation that it might be worthwhile to give sulfathiazole or sulfadiazine in adequate dosage for a prolonged period of time.

While only approximately thirty cases of this disease have been described in human beings, it is reasonable to expect a much greater reported incidence when the clinical picture becomes better recognized and more cases are looked for. In the case just discussed the diagnosis of toxoplasmosis has not been substantiated by demonstration of antibodies in the blood of the patient or his mother. However, the presence of typical findings in the eye grounds and intra-cerebral calcifications along with the general picture, constitute a fairly definite diagnosis.

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SPECIAL REPORT[1]

SUDDEN DEATH IN INFANCY AND CHILDHOOD

Dr. Julius Loebl

Sudden death, in a strict sense, is death without any premonitory clinical symptoms. This kind of death does occur in children and three such cases will later be discussed. Those cases, however, who are admitted to the Hospital naturally do show clinical symptoms. It seems more fitting, therefore, to call this discussion a review of cases of fulminating illness terminating in death. We have selected from our Hospital records those instances in which death occurred within 48 hours after onset of the initial symptoms.

Very little statistical material on this subject is available in the literature for either adults or children. The Vital Statistics of the United States are concerned only with causes of death rather than the duration of the illness.

The medical literature reviewed, presents a curious picture. The main interest in this subject is held by the Medico-Legal branch of the profession, who are interested in excluding homicide and foul play as the cause of death. The pathologists seem anxious to establish a definite cause of death and are apologetic in instances where that is impossible. The clinician is confronted with a patient who is evidently very sick but the signs and symptoms elicited, though they may be many, frequently permit diagnostic interpretation in different directions. The history is usually short and frequently inaccurate. The brief duration of the illness precludes, in many instances, the establishment of a diagnosis by laboratory methods.

E. B. Saye in the Southern Medical and Surgical Journal of August 1941 discusses "Sudden Death From Natural Causes." He summarizes, saying that "in adults the usual causes of sudden death (crime, accident and anesthesia excluded) are acute cardiac failure, often associated with disease of the coronary arteries, massive visceral hemorrhage, notably that from a ruptured aneurysm of the aorta or from a cavity in a tuberculous lung, asphyxia from an obstructive lesion of the upper respiratory passages, pneumonia, and, if the post-operative state be included, pulmonary embolism and peritonitis. "In children acute infectious diseases, particularly of the respiratory organs, intracranial hemorrhage, asphyxia from obstruction of some part of the respiratory tract, and visceral hemorrhage in the newborn are the main causes."

[1] Presented to the Staff Conference, May 5, 1945.

He reports the results of post-mortem examinations of 26 adults and 19 children from the records of 548 consecutive autopsies. The principal lesions in the latter 19 cases were pneumonia 5, intracranial hemorrhage 4, asphyxia 2; (1 from retropharyngeal abscess), congenital hydrocephalus 2, meningitis with aspiration of vomitus 1, spontaneous intra-abdominal hemorrhage 1, undetermined diagnosis 2.

Goldbloom and Wigglesworth report in the Canadian Medical Association Journal of February 1939 on "Sudden Death in Infancy." Their summary of 30 cases of sudden death in infancy has been analyzed—19 of these, at autopsy, showed definite inflammatory lesions, indicating, it is believed, fulminating bacterial infection. Four were asphyxiated from a mechanical cause, 3 from aspiration of milk and one from a large haemangioma of the trachea. The remaining case had in addition to healing pneumonia a most remarkable localized hypertrophy of the islands of Langerhans. Six patients showed indefinite inflammatory lesions but probably also died of fulminating infections.

John M. Adams reports in the *Journal of Pediatrics* of August 1943 three cases of sudden death in which autopsy indicated virus pneumonia was the cause. Follis, in the *Journal of Pediatrics* of March 1942 reported three cases of sudden death due to myocardial degeneration associated with scurvy observed at the Harriett Lane Home. Death in newborn due to overwhelming Lues is reported by Bonnet-Laborderie in the Revue de Medicine Légale of May 1913.

Some causes of sudden death in infants are well known. Among these we wish to mention diphtheria in which sudden death can occur in the malignant form due to overwhelming toxity or to myocardial failure. In nephritis, superimposed infection, cerebral edema, or myocardial failure in that order, may be responsible. Waterhouse-Friederichsen syndrome is typified by a fulminating course and sudden death. We recently observed one such case while on duty in the outpatient department—a child, nine months old and very well developed was brought in with a history of illness of about 12 hours duration. He had been gasping for breath in in the cab which brought him to the hospital and was dead on arrival. The entire body surface was covered with bluish-red petechiae. While the coroner who performed the autopsy made a diagnosis of septicemia due to streptococcus, we are convinced that we were dealing with a case of Waterhouse-Friederichsen syndrome. Accidents such as burns, falls, and automobile accidents are other causes of sudden death. The sudden anesthesia death is only too well known as is anaphylactic death due to allergy. A clinically latent brain abscess may result in sudden death without warning symptoms.

A short time ago a case of tracheobronchitis was observed on the ward

which did not respond adequately to the therapy employed. While the child was afebrile, and apparently at ease, dyspnea persisted. Suddenly on the 12th day of illness the child became extremely dyspneic and cyanotic, showed deep inspiratory retraction in the epigastric and suprasternal regions and died shortly thereafter. Autopsy showed an aspirated peanut at the carina.

A review of our cases reveals that during 1944 forty-two or 16% of the 266 deaths occurring at this Hospital were sudden deaths according to the aforementioned criteria. Thirty-two or 76% of these cases came to autopsy. For our analysis we shall sub-divide these cases into three groups, the newborn, infants from three weeks to one year inclusive and children above one year of age.

In the newborn group there were six patients, five of whom were autopsied. Five were white and one colored. Three were males and three females. These infants were born after six to nine months gestation and lived from 8 to 24 hours. Their weight ranged from 960 to 1585 grams. The clinical diagnosis was prematurity in all six cases and in two, atelectasis. The pathological diagnosis confirmed the impression of prematurity in four out of five autopsies and found pulmonary atelectasis present in all five. A patent ductus arteriosis was found in two instances. One infant born at $6\frac{1}{2}$ months of gestation and weighing 1000 grams who lived 15 hours was found to have a bilateral adrenal hemorrhage, which probably was the cause of death. In this instance birth injury and not infection appears to be the cause of the adrenal collapse. The heart's blood culture showed staphylococcus albus, evidently a contaminant.

The three weeks to one year old group was composed of 24 patients, 20 of whom had a postmortem examination. There were 18 white and 6 colored, sixteen females and eight males.

Congenital anomalies are quite prevalent in this second group, seven of the twenty patients that came to autopsy showed congenital anomalies which were probably contributory to their death. The following defects were noted: (1) patent foramen ovale, (2) intra-auricular septal defect and markedly dilated right auricle, (3) ventricular septal defect, (4) absence of gall bladder and extra hepatic duct system, (5) absence of right kidney and ureter, (6) microcephaly, (7) mongolism. Incidental congenital anomalies were (1) angiomata of mitral valve in two cases and of the tricuspid valve in one, (2) double ureter and kidney pelvis on the right and right ovarian cyst, (3) accessory spleen.

The causes of death in this group were bronchopneumonia 8 cases, Waterhouse-Friederichsen syndrome 4 cases, meningitis 1 case, and prothrombin deficiency 2 cases. The prothrombin deficiency was evidenced in one instance by absence of blood clots, pulmonary and extensive intra-

cranial hemorrhage. This is the case just mentioned that had no gall bladder or extra hepatic duct system. The second instance of prothrombin deficiency was characterized by a cerebral and subarachnoid hemorrhage, by bleeding from the gastric mucosa and by failure of the blood to clot within 24 hours.

Fatty infiltration of the liver was noted in 8 of the 20 autopsied cases. While usually seen only in protracted illness, the marked frequence of fatty infiltration of the liver seems to indicate that the *degree* of infection rather than the *duration* had an effect in its production.

The four cases which did not come to postmortem had a clinical diagnosis of bronchopneumonia in one case, congenital heart disease in two cases and subdural and epidural hemorrhage due to trauma in one case. It seems noteworthy that the latter is the only one out of 24 cases in this age group who died subsequent to accident.

The clinical diagnosis did not tally with the findings of the pathologist in three cases out of this group. In the remaining 17 cases they were essentially in agreement. In one instance the clinical diagnosis was congenital syphilis whereas autopsy showed bronchopneumonia with atelectasis and patent foramen ovale. In the second instance fulminating bronchopneumonia, possible asphyxia due to aspiration and possible congenital heart disease were diagnosed clinically while autopsy showed right partial and left complete pulmonary atelectasis, lymphoid hyperplasia and bilateral adrenal hemorrhage. Finally a case of bilateral bronchopneumonia was clinically diagnosed as asphyxiation.

The final group to be analyzed is that of children above one year of age, totalling 12, seven of whom had post-mortem examinations. Seven were white and five colored, nine were females and three were males. In only one instance was a congenital anomaly found, namely a patent foramen ovale.

Disagreement between clinical and pathological diagnosis was found only once. While the clinician diagnosed rickets, tetany, and mental retardation, the pathologist found pulmonary edema, fatty infiltration of the liver and an organized subdural hematoma. The latter might well have been responsible for the mental retardation of this child.

Causes of death in this group were bronchopneumonia 2 cases (23% of all cases reviewed); Waterhouse-Friederichsen syndrome 2 (a total of 6 or 13% of all cases); hemophilus influenza meningitis 1; and purulent meningitis of undetermined type 1 case. The remaining 5 cases in this age group died as the result of accidents (42% of this age group). There were two instances of fractured skull with laceration of the brain, two instances of 1st and 2nd degree burns and one case of asphyxiation due to aspiration of a bean.

We previously mentioned three cases who died at home without any or hardly any clinical symptoms. They were admitted to the Hospital for autopsy only. One patient, a six months white male, was believed to be in good health on the day of his death. The foster mother had observed the baby within an hour before death and noted nothing unusual. The only untoward manifestation was a small amount of blood which oozed from the mouth. A clinical diagnosis was not made. The pathological diagnosis was (1) enlarged thymus (2) bilateral bronchopneumonia (3) congestion of liver and kidneys (4) petechial hemorrhages involving the thymus and epicardium.

Another case was thought to have died of asphyxiation. The seven and a half weeks old female was apparently well when put to bed. At 7:00 A.M. the next morning she was found dead in bed. There was no evidence of vomiting or strangulation. Autopsy revealed bilateral bronchopneumonia, a double ureter with bifid kidney pelvis on the right and right ovarian cyst.

The third case, a two months old white female, was discovered dead in bed. She had been in good health and was apparently all right when seen by the mother before retiring the preceding night. Past history revealed that the mother had had a long and difficult labor. The pathologist's diagnosis: pulmonary and cerebral edema and cortical atrophy of the brain.

A much discussed, much supported and much doubted cause of death in infants is status thymico-lymphaticus which was first spoken of by Paltauf in 1889. He termed it "lymphatic constitution."

Czerny used to show cross sections of a whole infant taken at various thoracic levels in order to demonstrate the unimportant relation of the thymus to the trachea and great vessels and how the bulk of the thymus overlies the pericardium.

An enlarged thymus can be seen on AP x-rays of the chest and the resulting compression of the trachea on lateral views.

Goldbloom and Wigglesworth quote Mitchell and Brown who maintain that a careful study of young infants with respiratory difficulties, whatever the roentgen picture, will invariably demonstrate the cause of the dyspnea to be something other than the thymus. Such conditions as pulmonary atelectasis, micrognathia, nasal obstruction from syphilis or adenoids and prominent cervical bodies in the throats of mentally defective children have all at some time or another been mistaken for thymic hypertrophy or asthma. A special committee of the Medical Research Council and the Pathological Society of Great Britain and Ireland concluded in its report that "the facts elicited afford no evidence that so called status thymico lymphaticus has only existence as a pathological entity."

In reviewing our material, we considered any thymus of 20 grams or more

hypertrophied. We found an enlarged thymus in the two cases of prothrombin deficiency, in one case of meningitis, in four cases of bronchopneumonia and in four cases of Waterhouse-Friederichsen syndrome. In one other case of Waterhouse-Friederichsen syndrome the thymus weighed 12 grams and in one case the weight was not recorded. In four of these eleven cases of enlarged thymus bronchial, mediastinal, mesenteric and retroperitoneal lymph nodes were hyperplastic (3 cases of bronchopneumonia and 1 of Waterhouse-Friederichsen syndrome).

The high incidence of enlarged thymus in Waterhouse-Friederichsen syndrome should be incentive for further study. The question is still unsettled as to the interpretation of the hypertrophied thymus. While in All of the cases mentioned, the primary disease was adequate to produce death, it could be argued that the enlarged thymus predisposed these children to an infection of such severity. However, the enlarged thymus might be purely coincidental.

NEUROFIBROMA

Case Report No. 24

Dr. Elizabeth Linson V. S.—45-3204

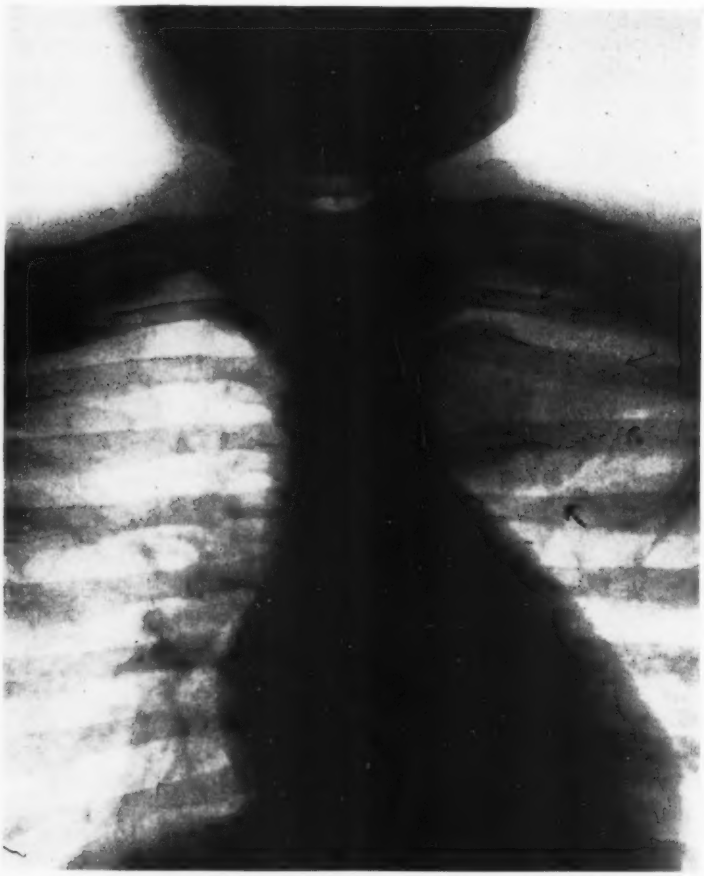
V. S., an eight year old white female was admitted to this hospital on April 19, 1945 for a thoracotomy. The first evidence of her present illness was noted in December 1943 when a routine chest x-ray was taken at another hospital, because of the history of a known contact with tuberculosis. The father of the child was diagnosed as having active tuberculosis and was admitted to a sanatorium for treatment at that time. The chest plate taken on the child was reported as showing a lesion in the apex of the left lung probably tuberculous in character. A Mantoux test (0.1 mgm. O.T.) gave a strongly positive reaction. She remained at home under the care of her private physician and during the next year she continued to appear to be in good health, showing a normal weight gain and no signs of chronic illness. The child was referred to Dr. Copeland in December 1944 for further study. At that time physical examination was entirely negative. The past medical history revealed that she had had three episodes of generalized convulsions occurring at the ages of 4 days, 15 days, and 9 months. These were attributed to hyperpyrexia and further information concerning these attacks was not available.

X-rays of the chest by various techniques were repeated on two occasions in December 1944 and were reported as showing a dense, well-circumscribed shadow measuring 4 x 6 cm. in the left lung apex extending from the mediastinum into the parenchyma in the first to third interspaces anteriorly and from the first to fifth interspaces posteriorly. Slight erosion of the inferior border of the third rib and the superior border of the fourth rib was also noted. Comparison with the x-ray taken in 1943 revealed that the mass had not changed in character or size during the preceding year and another x-ray taken on February 10, 1945 again showed no essential change. Dr. Lattman interpreted the findings as characteristic of a tumor of the chest, probably neurofibroma.

She was referred to Dr. Lambros for neurological examination and his findings were as follows: "The cranial nerves were intact. Fundi presented no abnormalities. There was a localized area of hypalgesia on the left chest wall extending from T_2 to T_4. Questionable hypalgesia was present in the right lower extremity. Muscle tonus and power were good.

Reflexes were equal in the upper extremities and slightly hyperactive in the left lower extremity. Plantar and Gordon reflexes were flexor on the

right and extensor on the left. Romberg was negative. No ataxia or incoördination was noted. Station and gait were normal."



V. S., NEUROFIBROMA
Note separation of ribs by the paravertebral mass

The pre-operative diagnosis was neurofibroma and a thoracotomy was done on April 20, 1945. An extract of the operative note by Dr. Edgar Davis follows: "Examination of the thoracic cavity revealed a large, hard, firm tumor which was obviously a neurofibroma measuring 6 cm. in diameter, located in the left costovertebral gutter. Further examination revealed

that this tumor had its origin predominantly from the 3rd dorsal, but also from segments of the second and fourth dorsal roots. The tumor was easily dissected free from the surrounding structures and the stalk of the fourth and second were severed without difficulty. After freeing the tumor from the second and fourth roots, the tumor mass was manipulated in such a manner as to remove the inner segment which was about the size of a split lima bean. The third root was then divided and the entire tumor was removed."

The child did well post-operatively and a chest plate taken on the tenth post-operative day showed the mass to have been completely removed. She was discharged on May 11, 1945. Three weeks after operation a check-up examination revealed: "Hypalgesia on the left extending from dorsal two to dorsal eight and questionable hypalgesia of the right lower extremity. The left lower extremity was slightly spastic and some weakness was present. Reflexes were hyperactive on the left, and there was some tendency to favor the left leg on walking."

She is now reported to be doing well at home.

Discussion

Dr. Vasilios Lambros. Neoplasma of the spinal cord are relatively rare in children, accounting for approximately one quarter of one per cent of all tumors of the central nervous system. In adults the incidence is almost one per cent.

The predominating type of tumor is the neurofibroma or meningioma, excluding the vascular anomalies which act as expanding masses and produce identical signs and symptoms.

Classifying the neurofibromas and meningiomas on an anatomical basis there are four divisions:

1. Intra and extradural
2. Intra, extradural and paravertebral
3. Extradural and paravertebral
4. Foraminal and paravertebral

The distinction between the neurofibroma and meningioma is more academic than practical. By definition a neurofibroma arises from the neurilemma surrounding a peripheral nerve and the meningioma from the meninges or other connective tissue of the central nervous system not of nerve tissue itself. Grossly, both types are usually encapsulated. The color of both is pinkish-grey with scattered yellowish areas, indicating softening and various degrees of degeneration. The grey areas are quite firm and probably represent the active portion of the tumor. Usually the nerve will be seen entering the medial aspect of the tumor and leaving from the lateral portion. The degree of vascularity varies with each case, some are highly vascular and others relatively avascular.

Histologically, the tissue structure is quite characteristic and two types are distinguished. In the reticular type, the cytoplasm forms an interlacing network between which are spaces suggestive of edema and numerous rounded cells filled with lipoidal granules. The second type, a dense tissue, is composed of interlacing elongated bipolar cells. Parallel to the long axis of the nuclei are numerous delicate strands of reticulin. Collagen is found only around the blood vessels of the growing portion of the tumor. Characteristically, the nuclei lie parallel to each other forming a so-called palisade effect.

The symptomatology varies with size and location. Root pain is often the first indication of the presence of a tumor. Motor and objective sensory findings vary with the size, degree and duration of the compression on the cord.

Diagnosis is relatively easy and can be confirmed by roentgenography. Characteristic x-ray findings, one or more of which may be present, include flattening and loss of convexity of the inner surfaces of the vertebral pedicles, increased vertical and horizontal interpedicular distance, bone erosion, a paravertebral opacity, and a compensatory curvature of the spine due to weakening of the ligaments.

The correct treatment is surgical extirpation. This was formerly done in a two-stage operation with removal of the interspinal portion first, followed by removal of the extraspinal portion. The method described in this case employs a single operative procedure by using a transthoracic extra-pleural approach.

With total extirpation the prognosis is excellent. Usually it is necessary to sacrifice the nerve with the consequent loss of one sensory and motor segment. It is exceedingly rare for these tumors to undergo malignant degeneration.

In the case presented, the tumor was of the foraminal and paravertebral type and was completely extirpated by the extrapleural approach. The residual symptoms described are probably the result of operative trauma and may completely resolve.

CLINICO-PATHOLOGICAL CONFERENCE

Directed by Dr. E. Clarence Rice
Assisted by Dr. John E. Cassidy
Held every Tuesday afternoon at 3 p.m.

SALMONELLA SEPTICEMIA

Case Report No. 25

Dr. Mary Warner D. P. (45-8)

D. P., a 4 months old colored female was admitted to the hospital on the evening of January 2, 1945 with the chief complaints of fever, lack of appetite and hyperirritability of one day's duration. There had been no vomiting and the bowel movements were normal. The infant had a "heavy cold" two days prior to admission. The birth history was normal, there were no previous illnesses and the family history was non-contributory.

Physical examination on admission revealed a well developed, well nourished 4 months old female infant who had a high-pitched cry, was very fretful and appeared acutely ill. The skin was clear. The temperature was 102° and respirations were 35 but not labored. The anterior fontanelle was tense and nuchal rigidity was elicited. Both lung fields contained numerous moist râles and bilaterally the breath sounds were bronchovesicular in character. The heart action was normal. The abdomen was distended and tympanitic. Liver, spleen and kidneys were not palpable and no masses were felt. Reflexes were equal and hyperactive. The differential diagnoses entertained on admission was either acute meningitis, acute bronchitis with menigismus or bilateral bronchopneumonia with meningismus.

The red blood cell count on admission was 3,790,000 with 9 gms. of hgb. White-cell count was 9,800 with a normal differential. The urinalysis was negative. A spinal tap done shortly after admission was negative and an x-ray of the chest showed evidence of bronchitic involvement.

The infant was started on sulfadiazine and supportive treatment. Within 36 hours the temperature had returned to normal and she remained afebrile during the subsequent week with noticeable clinical improvement.

She was scheduled for discharge on January 11th, the tenth hospital day, when she suddenly developed a severe diarrhea and the temperature rose to 104°. This occurred 26 hours after a blood transfusion but was not believed to be associated with it in any way. The bowel movements became liquid-yellow and had a foul odor. The infant appeared very toxic and began to lose weight rapidly. Parenteral fluids were employed and

formulae of high protein content and lactic acid were given but there was no improvement noted after 5 days. Physical examination failed to reveal any parenteral source for the diarrhea. The temperature was sustained at 103°–104° and she appeared critically ill. Respiratory and circulatory stimulants were given on January 15th.

Numerous laboratory tests were carried out to determine the causative factor. Two stool cultures produced no pathogenic organisms during the first week of the diarrhea. Preliminary reports on blood cultures were also negative during this time. E. coli were repeatedly cultured from the urine. Three microscopic examinations of the latter during the week of January 14th revealed many pus casts, white blood cells in clumps, coarsely granular casts and an occasional red blood cell. The results of the urine examinations indicated the existence of pyelo-nephritis or other renal infection. Widal agglutination tests were negative. The non-protein nitrogen blood level was 46 mgm./100 cc. and urea nitrogen 29 mgm./100 cc. Repeated spinal taps were negative as were x-rays of the chest on January 13th and 25th. On January 23, 13 days after the onset of the persistent diarrhea and sustained fever an organism was finally cultured from the blood. It was a gram-negative bacillus that had all of the characteristics of the genus Salmonella but the organisms were not agglutinated by specific serum or by the patient's serum. Two days later on January 25th, a stool culture produced an organism identified as Salmonella enteritides.

The hospital course after the onset of the intestinal infection was gradually downhill. The diarrhea was always severe. The temperature fluctuated between 101° and 105°. The baby was listless, toxic, cried almost constantly and vomited frequently. Sulfathiazole and sulfasuxadine were given in combination without any beneficial results. Continuous intravenous fluids including plasma and whole blood prevented marked dehydration and acidosis but that was all. Bone marrow infusions were employed and two occasions after "cut-downs" were discontinued. On February 4th, the day before the child expired, blood was noted in the stools for the first time. A movable mass was palpated in the right lower quadrant of the abdomen that did not have the contour of a kidney. The infant developed signs of intestinal obstruction shortly before she expired on February 5th, 1945. She had suffered for twenty-five days from a severe enteral infection and bacteremia caused by a paratyphoid organism. No other children in the ward developed salmonellosis and this case was considered a sporadic salmonella infection contracted in some unknown manner, probably in the ward.

Necropsy Summary

Dr. John Cassidy: The body was that of a fairly well developed, poorly nourished colored female infant of 5 months, weighing 5,300 gms. and

measuring 62 cm. in length. There were scars of venipuncture wounds on the medial aspects of both ankles and anticubital fossae. On the upper anteromedial aspect of the right tibia was a small abscess measuring 3–4 mm. in diameter at the site of a bone marrow puncture. The cisternal fluid was clear.

The usual Y incision was made on the trunk. There was no pleural effusion but the peritoneal cavity contained approximately 100 cc. of blood-tinged, cloudy fluid. The lungs presented the picture of a severe bilateral bronchopneumonia with marked congestion. The heart was normal in all aspects. The liver was pale, tan-yellow in color and waxy, indicative of fatty infiltration. In the lower pole of the right kidney there was a hemorrhagic infarct which measured approximately 1 cm. in diameter. The microscopic sections of the kidneys also revealed evidence of acute glomerulonephritis. The adrenals appeared normal. The intestinal tract presented the outstanding findings and these changes were quite striking. The caecum, ascending colon and a greater portion of the ileum appeared greatly enlarged and were deep red in color. The enlargement was due to a marked thickening of the walls of these portions of the gut. This thickening was caused by the presence of numerous small air bubbles throughout all the layers—an extensive emphysema of the wall. The mucosa of the ileum and colon was almost completely replaced by irregularly shaped nondiscreet areas of ulceration and necrosis. The mesenteric and retroperitoneal lymph nodes were greatly hypertrophied.

Cultures taken from the mucosa of the ileum, colon, gall-bladder and exudate from the tibial abscess, all yielded *Salmonella enteritides*.

Discussion

Dr. E. Clarence Rice: This case report serves to demonstrate the importance of bacteria of the Salmonella group as infecting organisms in babies and young children. At one of the meetings of the hospital medical staff, doubt was expressed by one of the physicians that members of the paratyphoid group could cause a very serious illness. Here we have evidence that a member of the Salmonella group, *Salmonella enteritides*, can cause death. We have only to go back several years to recall an epidemic of *Salmonella typhi murium* infection, so severe as to cause the staff to close one of the wards because of its virulence. Many think of the Salmonella as causing only enteritis and do not realize that a systemic type of infection with bacteremia or septicemia and a third type, meningitis, can occur.

Gross and microscopic examination of the tissues in this patient disclosed an extensive bronchopneumonia, marked fatty infiltration of the liver and an acute diffuse glomerular nephritis. Most interesting to us was the finding of an ulcerative ileocolitis with an emphysematous bowel. This latter has also been given the designation of gas cysts of the bowel or

pneumotosis cystoides intestini. The first named designation is quite as expressive and easier to remember.

We do not recall having seen this intestinal lesion prior to 1937 and we reported our first case (1). Since then six more cases have been observed at necropsy, five occurring within the space of a year. The lesion is so striking that it could hardly have been missed in previous autopsies. While this may not represent a very important condition it seems to be unmentioned in most textbooks and is hardly considered in the American literature. Moore (2) does devote some space to it in his recent Text book of Pathology.

This emphysema of the bowel always follows a break in the continuity of the mucous membrane of the stomach or intestine. The ballooning of the wall may occur some distance from the break in the surface epithelium. There is some question as to the exact mechanism responsible for the gas cysts, it has been suggested that gas can be forced into the lymphatics or other vessels or that bacteria may invade these passages and in multiplying, produce gas within the bowel wall.

It seems to me that both methods could operate. It is significant that this condition is seen most often in children rather than adults and it would seem that the violence of intestinal peristalsis and the more delicate condition of the gut of the young may render their bowel more susceptible. Some observers believe that this lesion is a post mortem one. We are of the impression that it represents a late or possibly terminal event but not something which happens after death. The cysts are found in the submucosa commonly, but may involve the muscularis. The inflammatory reaction is usually intense extending through all coats to the serosa.

Clinically one should suspect the presence of emphysema of the bowel in severe cases of diarrhea especially if a mass corresponding to gut can be felt. Roentgen examination should help in making a diagnosis but so far has not.

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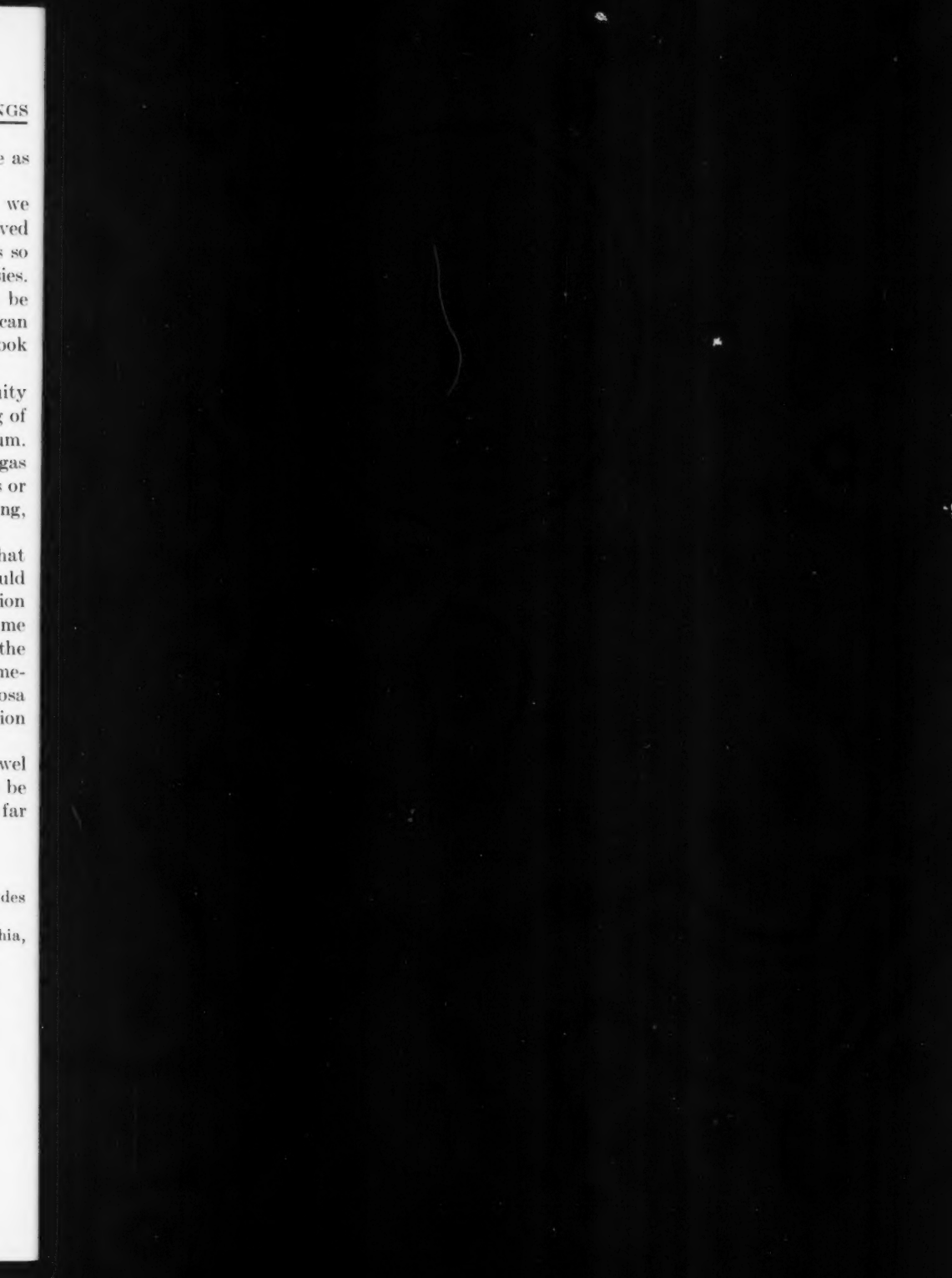
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